

CLAIMS

1. A method for designing a tire noise pitch sequence for a pneumatic tire; the method comprising the steps of:
 - selecting a number of modulation orders;
 - defining the amplitudes of the modulation orders;
 - defining the phases for each modulation order;
 - creating a function for each modulation order that includes the defined amplitudes and phases;
 - summing the functions that define the modulation orders; and
 - defining the tire noise pitch sequence from the summation of the functions.
2. The method of claim 1, wherein the step of defining the tire noise pitch sequence includes the step of calculating a determined number of pitch sizes from the summation of the functions.
3. The method of claim 2, wherein the step of calculating the determined number of pitch sizes from the summation of the functions includes the step of using the accumulation of the deviation of the arc length from the arc length of the mean pitch size.

4. The method of claim 3, further comprising the step of interpolating a curve defined by the accumulation of the deviation of the arc length from the arc length of the mean pitch size.

5. The method of claim 4, further comprising the steps of:

selecting the total number of pitches, the number of different pitch sizes, and the pitch ratios; and

fitting the determined number of pitch sizes to the selected number of pitch sizes.

6. The method of claim 2, further comprising the steps of:

selecting the total number of pitches, the number of different pitch sizes, and the pitch ratios; and

fitting the determined number of pitch sizes to the selected number of pitch sizes.

7. The method of claim 6, further comprising the step of setting the selected number of pitch sizes to a number between 3 and 7.

8. The method of claim 6, wherein the step of fitting the determined number of pitch sizes to the selected number of pitch sizes includes the step of identifying the range of determined number of pitch sizes and evenly dividing the identified range by the selected number of pitch sizes.

9. The method of claim 6, further comprising the steps of selecting the number of different pitch sizes to be 5 and selecting the pitch ratios to be 1.00, 1.10, 1.25, 1.40, and 1.50.
10. The method of claim 6, further comprising the steps of selecting the number of different pitch sizes to be 3 and selecting the pitch ratios to be 1.00, 1.25, and 1.50.
11. The method of claim 1, wherein the step of selecting the number of modulation orders includes the step of selecting between 3 and 7 modulation orders.
12. The method of claim 11, wherein the step of defining the amplitudes of the modulation orders includes the step of defining the amplitudes of the first and second orders to be smaller than the amplitudes of the remaining orders.
13. The method of claim 12, wherein the step of defining the amplitudes of the modulation orders includes the step of defining the amplitudes of the first and second orders to be zero.

14. The method of claim 12, wherein the step of defining the amplitudes of the modulation orders includes the step of varying the amplitudes for the selected modulation orders.
15. A method for defining a tire noise pitch sequences; comprising the steps of:
 - (a) first defining the characteristics of the tire noise generated by tire tread lug stiffness variations; and
 - (b) then defining a tire noise pitch sequence that yields the defined characteristics to provide preferred modulation characteristics and good level characteristics.
16. The method of claim 15, wherein step (a) includes the steps of:
 - defining the amplitudes of at least five modulation orders;
 - defining the phases for each modulation order;
 - creating a function for each modulation order that includes the defined amplitudes and phases; and
 - summing the functions that define the modulation orders to create a complex wave Y.

17. The method of claim 16, further comprising the steps of:
 - defining a lug stiffness variation curve (D_i) to be the accumulation of the deviation of the arc length from the arc length of the mean pitch size;
 - setting the lug stiffness variation curve equal to the Y curve; and
 - solving the equation to obtain a unique set of pitch sizes.
18. The method of claim 17, further comprising the steps of selecting the total number of pitches, the number of different pitch sizes, and the pitch ratios; and fitting the unique set of pitch sizes to the selected number of pitch sizes.
19. A tire comprising:
 - a body having a tread that has a pitch sequence; and
 - the pitch sequence having five different size pitches with pitch ratios of 1.00, 1.10, 1.25, 1.4, and 1.50.
20. The tire of claim 19, wherein the pitch sequence includes 53 to 80 pitches.